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ABSTRACT

This document contains three papers on aviation education. "Aviation/Aerospace Teacher Education Workshops: Program Development and Implementation" (Mavis F. Green) discusses practical issues in the development of an aviation/aerospace teacher education workshop designed to help elementary school teachers promote aviation to their students. "Globalization Strategies and the Prospects of Increased Competition in the International Airline Industry" (Scott E. Tarry, Lawrence J. Truitt) examines the potential impact of globalization strategies on competition in the international airline market. It concludes, from an analysis of four cases, that globalization strategies are reasonable for some airlines but may actually lessen the chance for real competition in the market even if ongoing government negotiations are successful. "Situated Learning: A Theory for Learning Situation Awareness" (Donna Forsyth Wilt, Philip Horton) examines the educational theory of situated learning (a theory based on the idea that learning takes place as interaction between a novice, an expert, and their social and physical environment) and its application in flight training. (MN)

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Collegiate Aviation Review

September 1995

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Collegiate Aviation Review is published annually be the University Aviation Association, and is distributed to members of the association. Papers in this volume were selected from all those submitted by a peer blind review process, and were presented at the 1995 Fall Education Conference in Las Vegas.

The **University Aviation Association** is the only professional organization representing all levels of the non-engineering/technology element in collegiate aviation education. Working through its officers, trustees, committees and professional staff, UAA plays a vital role in collegiate aviation and the aviation industry.

The UAA carries its goals through several specific objectives which are as follows:

- To encourage and promote the attainment of the highest standards in aviation education at the college level.
- To provide a means of developing a cadre of aviation experts who would be available for such activities as consultation, aviation program evaluation, speaking assignments, and other professional contributions that would tend to stimulate and develop aviation education in all of its phases.
- To furnish a national vehicle for the dissemination of intelligence relative to aviation between institutions of higher education and governmental and industrial organizations in the aerospace field.
- To permit the interchange of information between institutions that offer aviation programs that are non-engineering oriented, for example, business technology, transportation, and education.
- To actively support aerospace-oriented teacher education with particular emphasis on workshops and the development of materials.
- To actively support and provide for the administration of intercollegiate flying through the appointment of the National Intercollegiate Flying Association Council members and NIFA Foundation Trustees.

University Aviation Association
3410 Skyway Drive
Auburn, AL 36830
Phone: (334) 844-2434

Acknowledgments

I would like to acknowledge the several authors who submitted manuscripts for presentation at the 1995 Fall meeting of the University Aviation Association, and subsequent publication in this volume. A disappointingly low number of submissions were received by the editor this year. The situation is disappointing partly because of last year's record high number, and partly because of opportunities missed. Our fellows in aviation education have missed the opportunity to hear and read about new ideas, developments, and research. As individuals, some of us have not taken advantage of an excellent forum and opportunity for professional publication. Perhaps we can do better in 1996. In any event, it was a welcome task to receive, review, and select three papers for presentation this year. Authors of selected papers are commended for their efforts, and we look forward to the opportunity to see even more papers next year.

Thanks go to the panel of reviewers who take the time to evaluate each submission, comment, and make recommendations on acceptance to the editor. This "blind" review process is vital to the credibility of our presentations, and to the improvement of professional writing among our peers.

Special thanks also go to Mrs. Lyn Bubb, staff assistant in the Division of Aviation Studies at Florida Institute of Technology, for her assistance in receiving submissions, responding to inquiries, and preparing papers for publication.

Ballard M. Barker, Ph.D., A.A.E.
Chair, UAA Publications Committee
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Aviation/Aerospace Teacher Education Workshops: Program Development and Implementation

Mavis F. Green

University of Illinois

Abstract

This paper addresses development of an Aviation/Aerospace Teacher Education Workshop. This of workshop, targeted toward elementary school teachers to encourage the promotion of aviation to their students, has been successfully offered nationwide. This paper addresses practical issues dealing with program development including program intent, benefit to the sponsoring institution, program model, credibility, co-sponsorship and potential problems. Establishing an effective advisory committee and considerations when performing formative and summative evaluations are also discussed.

Program Development

Program Intent

Aviation/Aerospace Teacher Education Workshops are important to both the aviation and education communities. These workshops have been recommended by the Illinois Task Force for Aviation/Space Education (1988) as a way of encouraging aeronautical education. The Task Force was sponsored by the Illinois State Board of Education and the Illinois Department of Transportation - Division of Aeronautics and was comprised of a blue ribbon task force of professionals in both fields. The task force endorsed two initial premises:

> "Great technological challenges are being met by a dynamic aerospace industry that requires the intellect and dedication of motivated young people and an understanding public. Aerospace touches the lives of every citizen, yet the awareness of career opportunities, the economic impact, the beneficial spin-offs are little understood by the average citizen" (p. ii).

and that

> "The need for widespread aviation/space education in our schools and the public arena has never been more evident than today" (p.ii).

The need is not only specifically for aviation education, but for science education in general. Newspaper and popular magazine articles constantly bemoan the test scores of U.S. students in the sciences when compared with other countries. According to Strickler (in Illinois Task Force for Aviation/Space Education, 1988), trained educators see aerospace

education as basic education, and use aerospace as a motivating and meaningful medium through which to teach the basic academic subjects. They take advantage of the interests that students have in aviation and space to teach such basic subjects as geography, English, mathematics, science, physical education, arts, business, etc.

The aviation community also has a great need to diversify -- to encourage the participation of women and minorities. Currently, only 6% of all FAA certificated pilots are women. Early exposure to the potential opportunities in the field may help encourage future participation by this segment of society.

If there are so many advantages to aviation/space education, why is it not taught more in the schools? According to Marcec (in Illinois Task Force for Aviation/Space Education, 1988), the regular classroom teacher looks at aviation/space as another technical science area in which they do not know the terminology and do not understand the concepts. Familiarizing teachers with the topic, and especially how it can be correlated with non-science subjects, may increase their participation.

Sponsorship

A college or university is a logical sponsor of this workshop. Many institutes of higher learning have a threefold mandate which includes teaching, research, and service. These workshops would certainly help meet the public service requirement. Boyle (1981, p. 65) states that "Educational institutions should be responsible for facilitating the use of knowledge to serve the public."

Sponsorship of these workshops may also help an institution maintain support throughout its state for its other programs by showing that it is interested in promoting the general welfare of the state. An institutions willingness and eagerness to help implement this recommended course in the furtherance of improved elementary education by providing sponsorship and making its facilities available, may also help win political support in a time of budgetary constraints.

Program Model

There are a number of ways to discuss the model of program development suitable for this workshop. According to Boyle (1981), a model of program development is used as a rationale for selecting procedures. His "Institutional" classification seems to apply to the type of program being proposed: "Many professionals, such as teachers...are required to earn a certain number of units per year to update their knowledge in their field. They enroll in courses or workshops designed to develop or improve their understanding of new information and research as well as techniques" (p. 11).The objectives, which are developed from the knowledge within the discipline are, according to Boyle (p. 11), often part of a "larger problem-solving effort." In this case the problems which need to be addressed include

increasing cultural diversity in technically-oriented fields, improving science skills in U.S. students, and updating teacher competence and competitiveness.

The viewpoint to be used will have elements of the naturalistic as elucidated by Houle. Planning decisions will be made using practical contexts of action through a deliberative process in a specific context. Included, but not limiting, will be ideas from the "Classical" viewpoint of program development proposed by Tyler. The four questions posed by Tyler, including what result the program plans to obtain, through what type of educational experiences these results will be obtained, through what type of organization and how evaluation for achievement will occur are all essential to a program. However, many other questions must also be answered.

The situation must be properly analyzed, and the educational design chosen on this basis. Elements of Knowles and Donaldson seem especially important for consideration in development of this program. Knowles emphasizes participant involvement and utilization of experience. Teacher education must take into account the reality of the environment the teacher operates in and the individual teachers expertise in this area. Failure to do so will definitely result in alienating this population. Respect for the experiences of the teachers is essential to the success of the program. Their participation in developing curricula ideas from the knowledge provided them, as a goal of the workshop, is also essential to its success.

Communication and relationship building, as espoused by Donaldson (1990), is also extremely important. The power to influence teachers and to gain continuing support for the program, and for aviation in general, rests with the ability to build confidence in the sponsors' expertise and ability to understand the educator's workplace.

Potential Difficulties

Among the difficulties which might be encountered, gaining teacher participation looms paramount. Much of the incentive for teachers to enroll in the workshop must come from their ability to achieve continuing education units that can be used to either proceed toward an advanced degree or as a basis for fulfilling mandatory continuing education requirements leading to an increase in salary. Educational institutions need to provide innovative ways for teachers to meet these mandatory requirements (Boyle p.67). These credits must be offered to participating educators. The program will have potential economic benefit to the teachers if, as a result of obtaining credits, they receive a raise.

Weekend and summer workshops have also become less attractive to teachers as salary constraints make it difficult to receive pay for participation. Ideally, a grant can be obtained to pay the teachers full cost of enrollment, and provide a stipend for participation. A National Aeronautics and Space Administration grant that stipulates a portion of the money be used to promote and support these Aviation/Aerospace Teacher Education Workshops is a potential source of funding.

An additional obstacle to the participation of the teachers might be their fear of being "burdened" with additional material they must now shoehorn into an already overcrowded schedule. It must be emphasized to them, through marketing of the program, that the purpose of the workshop is to show how easily aviation topics and examples can be incorporated across their current curricula to enhance education.

Program Implementation

Advice and Support

There are many levels of support and advice that will be needed in ensuring an effective program. Caffarella (1988) talks about the need for support on the local, regional, state and community levels. Working within a university environment, this partially translates to support from within the sponsoring college. School systems within the host state, national sponsors and the trainees themselves must also be consulted. Munson (quoted in Caffarella 1988) states that within these areas, support must come form three major groups: top management, the immediate supervisors of potential training participants, and the trainees themselves.

Internal support. Within the aviation department of the sponsoring institution, active involvement should be sought from the director, assistant director, head of pilot training, and the chief pilot. At a minimum, their support must be rendered in the form of authorizing release time from normal duties for workshop organization. Optimally, however, their active involvement will allow utilization of their expertise for advice on implementation and scheduling. Their participation in events, possibly acting as instructors or resource persons, and assisting with the awarding of certificates at the end of the program, will also add greatly to the credibility of the program.

It is essential that teachers receive graduate or continuing education credits for attending the workshop. The appropriate colleges within the university should be consulted for advice on obtaining this credit for teachers. Faculty contacts willing to sponsor the program and participate are essential. Any requirements for classroom hours, curriculum content or instructor qualifications must be planned for in advance to insure against last minute surprises. Participants must be notified in advance of any paperwork they will need to have completed or credentials ready for presentation at the workshop.

External support. School principals and science program coordinators also need to be recruited for support of the program. Accepting the program as valid and offering in-house certification credit, where appropriate, will encourage attendance by their teachers . Their advice on developing curriculum ideas that will conform to any applicable state educational goals can also be helpful.

The support and advice of the trainees themselves is vital to the continuing success of the program. Any teachers currently using aviation materials in their class can be used as instructors or resource persons for a portion of the workshop. The success of future programs will depend on good word-of-mouth recommendations.

National aviation organizations and government agencies may also provide advice and information on resources available for the teachers to access.

Advisory committee. Program credibility can be offered through the establishment of an advisory committee with members from both the internal and external support groups. Caffarella (1988) says that subject experts, process experts, organizational leaders, and consumers are types of people needed on an advisory committee (see Table 1.) While an advisory committee is needed for program development, one is also needed for implementation. These two committees may be composed of the same, different, or additional members. It is essential, however, that the prime committee representative act as a stimulator (Apps p.83) to "sell" the program to the other advisors and co-sponsors. The other committee roles he lists must also be filled - analyst, facilitator, and encourager. An appropriately staffed advisory committee can add a great deal of prestige and credibility to a program, making participation desirable.

Expert knowledge on the committee must be provided in at least two domains: aviation subject matter, and presentation of material to elementary school children. Aviation experts can be provided from within the aviation department. The teachers, however, will be most concerned in how this material can be effectively used in their classrooms. An expert in elementary educational practice needs to be included in the planning process.

The process expert will be the program planner, but may include others with similar functions within the institution. The program planner must be able to establish linkages between the diverse groups involved in the program, and establish comfortable working relationships based on mutual trust. The less pleasant role, as suggested by Dahl, might be one of "administrator", ensuring all work is performed on schedule. The planner must also act the role of entrepreneur. While ideally, the costs of the program will be covered by grant money, the full variety of support needed to make the program viable must be actively solicited.

Organizational leaders that need to be consulted for advice include the National Aeronautics and Space Administration, the Federal Aviation Administration, the Civil Air Patrol, and the state D.O.T./Division of Aviation. The Aircraft Owners and Pilots Association and General Aviation Manufacturers Association may also be useful in supplying advice on program implementation. These organizations may be interested in sending speakers to participate in a portion of the workshop. Their participation would also lend additional credibility to the program.

Last, but absolutely not least, is participation by the consumer - -again emphasizing the importance of including an elementary school teacher on the advisory committee. Teachers will be enrolling not simply for aviation knowledge, but for ideas on how they can use this knowledge in their classroom. It is essential that an elementary school teacher be included in the program planning advisory committee. That teacher should be involved in every aspect of program planning and activity development to insure that the program remains relevant to the concerns of the teachers. The teacher should also be involved with program implementation to provide insight into elementary training needs. Boyle (1981) feels that having client representation will speed up the process of change and reduce resistance to the program (p. 95). He also feels that those who are involved will aid in diffusing information about and legitimizing future programs. The advice supplied by this individual can help insure that the program is addressing needs and supplying information of use and interest to the participants.

Program Objectives

Houle states that "Any learning activity is...a force field in which many other purposes than the professed goals are in operation,..." An explicit objective may be that professed goal - the intended result of a specific training activity (Caffarella 1988). The "other purposes" may be thought of as implicit objectives. It is important for the program planner to be aware of both explicit and implicit objectives in order to design learning activities that will orchestrate between them and enable them to be met. There are three major categories of learning outcomes: Knowledge acquisition, skill building and attitude change. Educational objectives, focusing on the learners, are based on these possible outcomes and are composed of three components: performance, conditions, and criterion (Caffarella 1988).

Table 1

Recommended Program Planning Advisory Committee Membership

Type Caffarella(1988)	Example
Subject Experts	Aviation Education Specialist Elementary Education Specialist
Process Experts	Administrator/Analyst/Facilitator
Organizational Leaders	Governmental Representatives: FAA, CAP, NASA Industry Representatives: AOPA, GAMA
Education	Education Representatives: Dept. or Board of
Consumer Representatives	Elementary School Teacher

Explicit objectives. The explicit objectives of the workshop fall primarily in the knowledge and skill building domains. At the outcome of this workshop the participants will be able to explain aviation fundamentals. They will be able to recognize the applicability of aerospace education across the curriculum and be able to prepare lesson plans that incorporate aviation themes. The participants will also be able to describe issues facing aviation today.

Implicit objectives. The implicit objectives for the workshop seem to fall primarily into the attitude domain. One objective is for the participants to become advocates for aviation in general. The participants will accept and recognize aviation as a motivating and meaningful medium through which to teach basic academic subjects as well as technical material. They should endorse the use of aviation across their curriculum and select to use lesson plans incorporating aviation themes. A final implicit objective is to build good will toward the sponsoring institute.

Learning Activities

A variety of instructional techniques should be used to obtain the explicit and implicit objectives. This workshop will provide continuing professional education to elementary school teachers, and must address preferred learning styles. Adults in general, according to Knowles, prefer a problem- based orientation. Teachers in particular want hands-on experiential learning experiences that have immediate and practical application in their classroom. A combination of lecture, guest lectures, simulations, video, demonstrations and hands-on projects, case studies, group projects, written assignments and field trips will be used during the week-long course of the workshop.

A knowledge base does have to be developed during each unit of instruction. This will be accomplished primarily through lectures , group projects and demonstrations. It is extremely important that each lecture present not only subject content, but suggestions for and examples of integration into a primary curriculum. Skill building will occur through case studies, hands-on projects, and written assignments. Attitude changes will occur through the interaction of all the designated learning activities.(Caffarella 1988)

Program Evaluation

It will be important to evaluate this program in a number of different ways. The overall value of the program and its ability to meet the stated objectives must be evaluated to determine if the program should be continued as is, modified, or discontinued. It is also important to evaluate each unit of instruction for effectiveness and relevance for the participants.

There is a danger in overevaluating, especially in terms of participant dissatisfaction. In terms of formative evaluation, two short evaluation cards could be provided to the teachers each day. One card could be at the classroom desks in the morning and collected as

participants leave for lunch. The second card could be completed at the end of the afternoon. Evaluation of specific program activities will be less reliable the farther removed in time from the actual learning experience, and so should be done immediately following the session to be evaluated. The formative evaluation process may help foster a feeling of collaboration among the workshop participants. Also, changes in the format of following lessons can be made in a timely manner, if needed, to help ensure the success of the program.

Questions can be posed on a Likert-type scale, allowing participants to agree or disagree along a continuum. Space should be included, however, for general comments from the participants. At times, items that have not been considered for evaluation get brought to the forefront in this manner. Teacher responses should not be unduly restricted.

Summative evaluation to determine to what extent course objectives have been met can occur through a questionnaire mailed to participants six months after course completion. This form can solicit information on how the teachers are using aviation in their classes, as well as their overall impression of the usefulness of the program to them and their students.

Comments

An Aviation /Aerospace Teacher Education Workshop has the potential to be a first rate program that will benefit both the sponsors and attendees. The relationship that will be established between the sponsoring institution and the participating teachers will be important to both. These teachers can help maintain a steady flow of students into the institutions aviation programs. The teacher/participants will be able to make contacts with teachers of similar interests through the program and will have the time to forge strong relationships. The good feelings the participants will leave with will hopefully translate into positive action in support of aviation .

The big winners, however, will be the students. As the students become educated about aviation in their classes they may not elect to fly or pursue aviation as a career. They will at least, however, be able to analyze issues dealing with aviation more knowledgeably. Hopefully, they will support aviation in a time when the industry appears to be under fire. They will undoubtedly have teachers who are better able to prepare them for the technological challenges they will encounter in the century to come.

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Globalization Strategies and the Prospects of Increased Competition in the International Airline Industry

Scott E. Tarry and Lawrence J. Truitt

Southern Illinois University at Carbondale

Abstract

As governments debate open skies agreements, airlines are often left to find strategies that allow them to survive while waiting for a more liberal trading regime for international air travel. Airlines present an interesting theoretical case because they fail to conform to generally held notions about firm demands for protection or liberalization. The primary confounding factor in analyzing airline behavior is the pursuit of globalization strategies. This paper examines the potential impact of globalization strategies on competition in the international airline market. The conclusion from our initial analysis of four cases is that globalization strategies are reasonable for some airlines, but such strategies may actually lessen the chance for real competition in the market even if ongoing governmental negotiations are successful.

Introduction

It is often assumed that globalization and liberalization go hand in hand in the international economy. This thinking is based on the notion that as markets and firms become more global, political pressure for liberal trading arrangements increases. Multinational firms, international joint ventures, and export dependent firms are expected to push for open access to markets. On its face, this seems to suggest that such firms are willing to accept more competition in exchange for access to new markets and fewer barriers to trade. By linking these expectations and assumptions some scholars and policy makers conclude that globalization strategies and liberalization policies are complementary steps towards the larger goal of a competitive free market international economy.

This paper examines these assumptions and expectations more closely through an analysis of the international airline market. We find that standard expectations about firm preferences for liberal trading arrangements generally do not hold. Moreover, we conclude that the push for globalization in the airline industry is a product of forces that are not commonly associated with liberalization, but rather those forces normally associated with protectionism and anti-competitive behavior. Finally, we offer a general model for understanding how firms devise strategies and attempt to influence policy while trying to maintain a credible market presence under increasingly fierce competition.

The standard hypotheses concerning firm-level preferences for liberalization or protection are inadequate when applied to the international airline industry. In contrast to the conclusions drawn from studies of other industries, we find no clear relationship

between firm health and demands for protection. Where the traditional hypothesis suggests declining firms should seek protection, we observe that trade policy preferences and commercial strategies adopted by various airlines do not follow the expected course. Similarly, we find that levels of multinationality and export dependence do not necessarily lead firms to prefer more liberal trade strategies.

The reasons for this mixed bag of trade policy preferences and commercial strategies can only be explained by expanding the analytic lens to include changes in governmental policy, market structure, and technological innovation in the airline industry. Specifically, our examination of the U.S.-European international airline market confirms that the political processes that opened up the American domestic market are working towards opening the European Union market and the Transatlantic market as well, albeit at a more cautious and deliberate pace. We identify additional factors in the debate over liberalization of the international airline market and show why these must be incorporated into the analysis of both firm trade policy preferences and the prospects for further liberalization of the global air transportation market.

Firm-Level Preferences for Trade Liberalization or Protection

A popular approach to understanding trade policies is to examine the interests or preferences of firms. The basic assumption of this approach is that firms generate preferences for trade policies and attempt to influence governmental decision makers accordingly. The theoretical foundation for this work is rooted in the literature on endogenous tariff theory (Magee, Brock, and Young, 1989; Brock and Magee, 1978; Baldwin, 1986) and firm preferences for trade policies (Odell and I. M. Destler, 1987; Milner, 1988). This literature spans both political science and economics (Nelson, 1988; and Magee, 1994).

Three important hypotheses derive from the theory of firm preferences for trading policies. Firms experiencing a decline in profits, a deteriorating market share or other maladies will prefer protectionism (Hillman, 1982). Firms that rely on international markets or exports for the bulk of their business are more likely to oppose protection and favor liberalization (Ferguson, 1984). Finally, intrafirm trade among multinationals leads these firms to prefer liberal trade policies over protectionism (Strange, 1985).

These arguments are appealing because they model firm level preferences as a function of three seemingly parsimonious variables: firm health, level of multinationality, and export dependence. Several interesting questions arise, however, when these hypotheses are examined in the context of the international airline industry. The assumption made by Milner (1988) and others that export dependence is positively correlated with preferences for trade liberalization seems to fall apart in the face of preliminary evidence from the U.S. airline industry. In the wake of domestic deregulation, carriers whose business was either exclusively domestic or exclusively international were either opposed or ambivalent to efforts aimed at liberalizing the international market.

Studies by McKeown (1984) and others that focus on firm health and argue that troubled firms will seek protection seem to falter when applied to the airline market. Again, using preliminary analysis of the U.S. industry, firms in financial distress often pursue both commercial and political strategies that are seemingly more in line with liberalization. Finally, the notion that multinationality increases the desire for liberal policies seems tenuous in the context of the recent proliferation of agreements between American and European airlines. On the surface, these alliances appear to be a move toward liberalization. However, a more careful examination of these firm strategies reveals that such arrangements can, in fact, be protectionist. Joint marketing and operating arrangements allow airlines to rationalize the market and deter competitors from entry. By far the most important type of alliance is code sharing, which involves placing one carrier's two letter designator code on another carrier's flight, allowing these airlines to operate as a seamless service network. This creates global carriers without necessarily enhancing competition or furthering liberalization.

Liberalization, Globalization, and Competition in the International Airline Industry

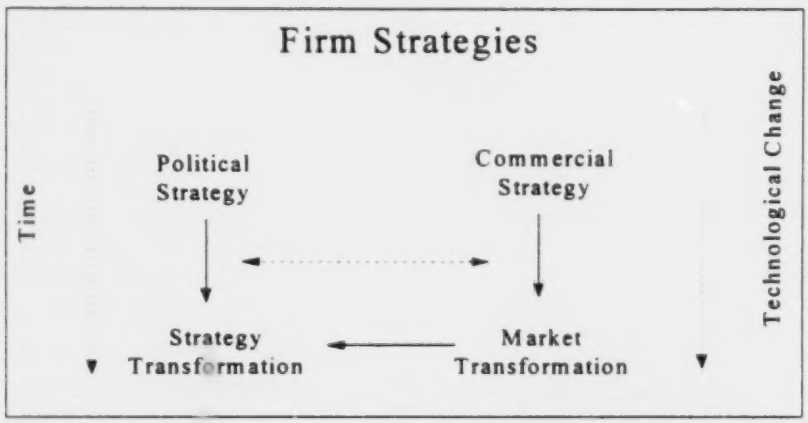
We are left to speculate why the hypotheses described above do not hold when applied to the international airline market. At first glance, there is no reason to believe that airlines should operate or generate preferences uniquely. The puzzle is whether airlines are inherently different from other firms operating in the international political economy, or alternatively, whether the environment in which airlines operate shapes the relationships between the variables discussed above and firm preferences in ways that are not easily understood. A tempting explanation is simply that the special relationship between the airline industry and national governments produced a unique market structure in which firms never had to face the forces of competition until the 1980s. This account helps explain some of the preferences and strategies adopted by U.S. airlines, however, it leaves other important questions unanswered.

In the balance of this paper, we assess the development of the international airline industry and provide a new approach to understanding the linkages between politics and firm strategy in both domestic and international industries. Firm health, multinationality, and export-dependence are re-defined and incorporated into a new model of firm preferences. The model places these variables in the larger political and commercial contexts in which firms generate preferences. The model breaks firm behavior into two tracks, each with its own set of strategies. The tracks are political and commercial. The political track involves strategies and behavior designed to influence the political process in ways that meet the firms' interests . The commercial track involves strategies and behavior designed to meet the challenges of the increasingly competitive marketplace. Of course, these tracks are not separate in reality, but it is useful to separate them for the purposes of understanding how firms formulate preferences for different trade policies.

A Model of Airline Strategies

Time is an important, yet often overlooked, variable in the process of influencing policy formation. It takes some amount of time for a firm or any other interest group to mount an effective campaign to influence policy. On rare occasions attempts to influence governmental policy work quickly and effectively, but in most cases the attempts are either lengthy or fail all together (Baumgartner & Jones, 1993). We are especially interested in the latter case, where the process of influencing the government to implement a seemingly favorable policy, or in this case to aggressively negotiate the expansion of "open skies," is difficult and time-consuming. The process of changing international airline policy is politically sensitive since it involves a clash of powerful interests that makes change difficult under the best of circumstances (Milner, 1988).

Figure 1
The Interaction of Political and Commercial Strategies



The model presented in Figure 1 depicts the process by which the transformation of strategies and decision making environments occurs over time. This framework is employed later in the paper to illustrate the dual track strategic decisions made by several U.S. and European airlines in recent years. Time and technological change are important factors in shaping firm strategies which, in turn, alter the market and subsequent firm behavior. The diagram suggests that over time commercial strategies may alter the market and a firm's policy preferences.

As governments are either unwilling or unable to implement a firm's preferred policies, the firm must continue to meet the demands of the marketplace and respond to the competitive actions of other firms in the oligopolistic airline market. The longer it takes for

the government to implement favorable policy, the more likely a firm is to adopt survival strategies that deal with the realities of the marketplace, even if these strategies are in opposition to the preferred policy sought on the political track. In the end, the commercial strategies adopted to address the demands of the market may actually create a situation in which the firms' political strategies are transformed because of their weak financial condition or because of the nature of the market has been transformed by technological and marketing innovations.

The critical feature of this model is how time interacts with the preferences of the firms and their ability to influence the political process. Needless to say, market structure also affects the eventual outcomes by shaping the strength and needs of individual firms as they attempt to alter policy. The factors traditionally thought to shape firm preferences: firm health, multinationality, and export dependence take on new meaning as firms attempt to secure favorable policies via the political track while at the same time pursuing commercial strategies that include joint marketing and operating alliances with foreign airline partners.

Competition in the International Air Travel Market

In contrast to all the debate and fanfare over domestic deregulation, it is interesting to note that Congress enacted the International Airline Competition Act of 1979 with little publicity. This event marked a third attempt to encourage and promote open competition, or "open skies" in the international airline market (Clarke & Gourdin, 1994). American economic and political decision makers, even those who worried about the negative effects of domestic deregulation, believed U.S. airlines would dominate a liberalized international air travel market. The reality has been somewhat mixed. America's traditionally dominant international carriers, Pan Am and Trans World Airways (TWA), discovered quickly that their initial optimism was unwarranted. The U.S. government was not successful in opening the world's skies quickly. More importantly though, the once proud international carriers found that the combination of domestic deregulation and international liberalization left them unable to effectively compete against some of their stronger American competitors. Pan Am, for example, lacked the domestic feeder network to transport passengers from various cities throughout the U.S. to international gateway airports from which Pan Am provided scheduled service to Europe and other parts of the world. Passengers who might have traveled on a transnational carrier to connect with Pan Am for the international leg of their journey were no longer forced to endure the hassles of changing carriers and opted for single carrier service from their original points of departure to the cities of Europe.

Domestic deregulation and the widespread adoption of hub and spoke route structures required airlines to expand services quickly. Financially weak carriers chose to cut fares, causing fare wars, which are a classic characteristic of oligopolistic market structures. Consequently, the entire domestic industry was forced to offer services at prices which were below fully allocated costs, which is not a viable long-run strategy. This

unsustainable fare structure forced carriers to compete in other ways, namely, through incentive programs such as frequent flyer programs that give travelers free flights after the accumulation of a predetermined number of paid miles. The first frequent flyer program, AAdvantage, was introduced by American Airlines in 1981 (Levine, 1987).

Several U.S. airlines struggled for survival in the face of this fierce competition. Financial problems forced some carriers to seek foreign assistance through joint equity arrangements. Other carriers, decidedly impatient with the government's efforts, sought code sharing (the computerized linking of separate airlines into a somewhat seamless system of computerized reservations and transportation service) and other joint operating agreements with foreign carriers to pry the skies open. The result is a complex commercial and political environment.

The events that occurred in the U.S. airline industry during the 1980s were certainly not ignored by foreign competitors, particularly in Europe. The European Union's (EU) goal of an open internal market for members is confounded by the fact that no member abrogates its air sovereignty by membership in the EU. During the 1980s there was a tendency towards more liberal bilateral air services agreements, however, not the "open skies" type of deregulatory policy called for in the International Air Competition Act in 1979 (Bueno de Mesquita & Stokman, 1995). The EU has enacted several changes including the removal of some traditional protectionist policies, but most of the changes only affect airline services within the European Union. Not surprisingly, many proposed EU policies and those now in effect favor European flag carriers at the expense of large U.S. carriers such as American, Delta, and United Airlines (Clarke & Gourdin, 1994). Non-member access to European airports remains an important and divisive issue (Doganis, 1994).

Case Studies

The following cases demonstrate that the commercial behavior of U.S. airlines in the wake of deregulation combined with European resistance to open skies creates a Faustian bargain for some U.S. carriers. Those in poor financial condition chose innovative commercial strategies to cure their ills, while those in prime condition found political change a fleeting possibility. In the end, virtually all airlines, regardless of policy preference and financial health chose some form of globalization strategy that may actually make liberalization more difficult to achieve.

We examine four cases to illustrate the interaction of political and commercial strategies over time and in the context of changing technologies and market structures. The first two cases involve ailing U.S. airlines and their attempts to enhance their prospects for survival while not losing out on the opportunity for a share of the global air travel market. The other cases involve U.S. carriers whose financial survival was not in doubt, but whose management believed they were not being given sufficient access to foreign markets to effectively exploit their comparative advantage over foreign carriers.

Northwest Airlines

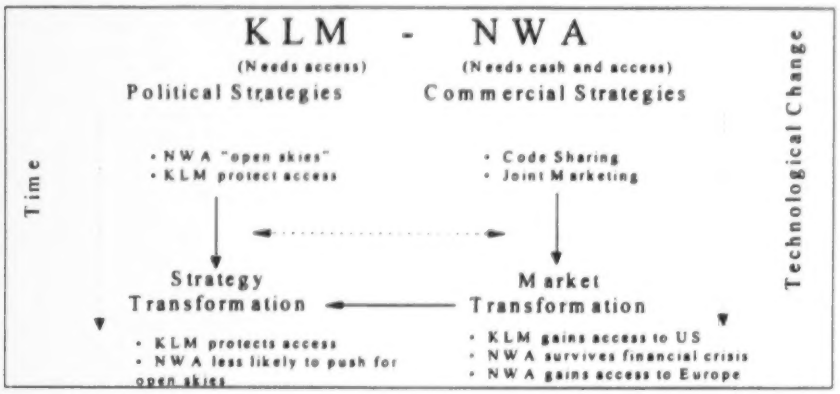
Deregulation of the domestic airline market brought a number of unanticipated consequences. One of the most important was the dramatic increase of debt taken on by American carriers that hoped to expand quickly to take advantage of economies of scope in the newly competitive domestic market. These strategic moves were not problematic in and of themselves, but the combination of inexperienced management, fierce competition, and enormous debt loads at high costs of capital left some carriers in precarious financial positions despite significant and seemingly successful operations. The merger mania that gripped American business in the 1980s fueled by the emergence of risky high-yield "junk" bonds was particularly problematic for the U.S. airline industry which is highly cyclical.

Northwest Airlines (NWA) falls squarely into this category. Like so many other American corporations in the 1980s, NWA attempted to expand its operations by growing through merger and acquisition. NWA completed a merger with Republic Airlines (which had itself taken over both Hughes Air West and Southern Airways in the early 1980s) in 1985 through a leveraged buyout (LBO). LBOs are typically financed through the sale of high-yield or "junk" bonds. On its face, this was not a bad strategy considering that deregulation and the evolution of the hub and spoke system meant that the carriers that could move quickly to expand services would reap long term benefits of larger market shares and dominant competitive positions. A few years later, Northwest found itself in a takeover battle with a group of California investors headed by real estate developer Albert Checchi. Checchi's group was ultimately successful in its takeover of Northwest, with junk bonds providing the primary source of funds for the takeover (Lipin & Quintanilla, 1995).

Even well-managed firms meet with disaster after assuming enormous debt loads. This was especially true in the airline industry where the management of many U.S. carriers were not prepared for the rapid decision making dynamic of an openly competitive market. Decades of regulation protected mediocre managers and dampened the effects of poor decisions. In fact, economic regulation removed many of the incentives for efficient performance. Northwest, like so many other U.S. carriers found itself ill-equipped to handle the rigors of competition. In the end, its commercial strategy of expansion through increased debt altered the way in which NWA entered the competition for position in the international air travel market (Lipin & Quintanilla, 1995).

One might expect that NWA launched a similarly aggressive scheme to capture a share of the international market. Two issues prevented this from happening. First, expansion in the international market requires access to airports and foreign airspace. Even as air space restrictions were diminishing through bilateral negotiations, a lack of access to airports, because of restrictions on access to gates or slots made expansion difficult. Moreover, NWA's financial difficulties made growth an onerous proposition. So while the airline initially preferred open competition in the international market, it found alternative arrangements commercially imperative.

Figure 2
The Interaction of Strategies in the KLM - NWA Agreement



NWA's subsequent commercial strategy was to form an alliance with KLM, a Dutch carrier, who would take part ownership of the troubled carrier through a $400 million investment in 1989 (GRA, Incorporated, 1994). The investment was necessary to keep NWA from joining other troubled U.S. carriers seeking bankruptcy protection. KLM received access to NWA's hubs in Minneapolis, Detroit, and Boston. Eventually, the arrangement was formalized into a joint marketing and code sharing alliance that allowed NWA and KLM to list each other's flights on computer reservation systems. A bilaterally negotiated "open skies" agreement between the Netherlands and the U.S. was signed in 1992 that allowed unlimited code sharing for Dutch and U.S. carriers (GRA, Incorporated, 1994). While the agreement did not specifically name the KLM-NWA agreement as its motivation, the reason for the agreement is clear. It is not unusual for general bilateral agreements between two countries to address the specific demands or needs of a single carrier. The recent "minideal" between the U.S. and Great Britain is a case in point where United Airlines was granted a Chicago-London route.

NWA gained an important infusion of cash through the agreement. It also gained access via code share to more European destinations, even though it would stop actual NWA service to at least seven cities previously served by Northwest jets (U.S. GAO, 1993). KLM assumed responsibility for delivering NWA passengers to these cities as well as other traditional KLM destinations. KLM gained considerable access to the U.S. market via the joint operating agreement. It also gained a voice in the operation of a major U.S. carrier.

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Perhaps more importantly than the individual gains to either airline is the positive impact the new operating arrangement had on KLM-NWA as an aggregate body. KLM was cash rich, but access poor before the deal with NWA. It could offer considerable access to major European destinations, but without better access to the U.S. it would likely fail in competition with other European and U.S. carriers. NWA was cash poor, but access rich, especially in terms of its dominant hubs at Minneapolis and Detroit. The resulting arrangement made good sense for both parties and provided an even more dramatic side benefit. The joint operating agreement effectively created a global carrier. KLM's links to Europe and NWA's links to the U.S. and Asia make the aggregation of the two carriers a dominant force in the international air travel market. Competitors in the U.S. or Europe that do not have similar economies of scope or market access will find it difficult to compete or even enter the market against such formidable competition.

Clearly, NWA is in favor of globalization. Such a commercial strategy worked handsomely to prevent the airline from demise. It is unlikely, however, that this enthusiasm will translate into support for further liberalization for a number of reasons. First, despite the multinationality of NWA-KLM's joint operating agreement, it is not in their interest to aggressively pursue "open skies" that will allow more open competition in the international market. Their agreement is tailored to the commercial and political realities of several years ago when the only way for access to foreign markets in any meaningful sense was through such arrangements. Now that a commitment has been made, especially the KLM investment, it is unlikely for either airline to support American Airline's bid for complete and open access to all markets. Globalization in this case increases the multinational character of the operations and the ownership structure, but actually decreases the demand for liberalization of the market. The commercial strategy taken by KLM and NWA altered the market structure, which in turn effectively altered the political strategy of each firm as it sought government support for favorable policies in the international airline market.

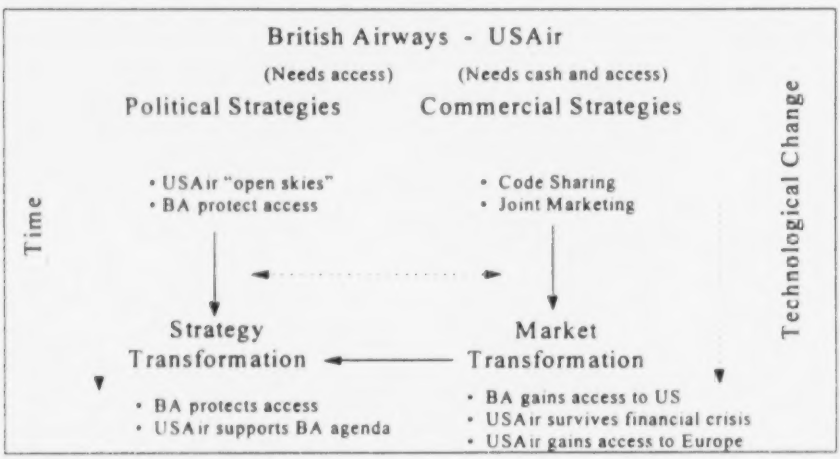
USAir

Northwest Airlines was by no means the only U.S. carrier that found itself in need of financial assistance. For many of the same reasons that plagued NWA, USAir found itself in dire straits at the beginning of the 1990s. USAir also joined in the merger mania that characterized U.S. industry in the 1980s by acquiring both Piedmont Airlines and PSA in the mid-1980s to attain "critical mass" and to enjoy the economies of scale and scope that conventional wisdom of the era deemed necessary for survival (Levine, 1987). Rapid expansion and unexpected difficulties resulting from combining the vastly different corporate cultures, varieties of aircraft, and operating procedures of the acquired airlines caused serious problems for USAir management. The fierce price wars of the 1980s caught up to the airline and left it on the teetering on the brink of bankruptcy. To the dismay of many industry and government actors, USAir found a white knight in the form of British Airways. The subsequent equity and operating alliance between the two airlines illustrates

further how the political strategies of air carriers can be confounded by commercial realities and changes in market structure.

In 1991, the U.S. and Great Britain negotiated a bilateral agreement that permitted broad code sharing arrangements between the nations' carriers (GRA, Incorporated 1994). At the time, British Airways made no moves to initiate such an arrangement with a U.S. carrier, waiting instead for a more attractive arrangement. Its strategy was shaped in part by the intense pressure being exerted by American Airlines and United Airlines on the U.S. Government to force the British to open up Heathrow Airport to U.S. carriers. These airlines believed that a truly open arrangement would allow them to take advantage of their more efficient operations to compete effectively against the British and other European carriers. Many European airlines were suffering enormous losses, requiring significant cash infusions from their national governments to remain aloft.

Figure 3
The Interaction of Strategies in the BA - USAir Agreement



While the British government, and other European governments, resisted open competition, carriers like British Airways desperately sought ways to maximize their dominant position in Britain and the broader European market. Code sharing offered the best answer. The stronger U.S. carriers were wary of such an arrangement because they still held out hope for open skies and real competition. Small carriers didn't offer the scope of service that only a true hub and spoke operation could provide. Since Northwest was already taken, British Airways selected USAir as its partner.

Just as KLM rescued NWA with a cash infusion, British Airways saved USAir. An initial investment of $750 million that would give British Airways a 44% stake in the carrier and 21% of its voting stock was tendered, but withdrawn after well-publicized criticism by industry and political leaders. Eventually, the deal was consummated in the form of a $300 million investment and a 19.9% voting stake in the U.S. carrier (Newhouse, 1993). The joint operating agreement is similar in many ways to the one struck between KLM and NWA, but there are striking differences as well. British Airways currently holds a 24.6% voting stake in USAir, which is just below the legal limit of 25% foreign ownership. Perhaps more importantly, British Airways also hold three USAir board seats, giving it considerable influence in the operation of a large U.S. airline (GRA, Incorporated, 1994).

British Airways clearly dominates the arrangement. The British carrier essentially makes all policy choices regarding service provided in the joint agreement and how code sharing will be handled. USAir does not put its code on British Airways flights. As a result the arrangement appears to be a one way street in terms of marketing and service. Whereas the KLM-NWA arrangement is a joint marketing plan, the British Airways-USAir deal is much more like a feeder or subsidiary relationship typical of the arrangement between large U.S. carriers and various regional airlines that serve as feeders for their larger code sharing partners.

The arrangement between USAir and British Airways suggests conclusions similar to those reached in the analysis of the KLM-NWA case. Both airlines faced political and commercial conditions that necessitated a new strategy. For USAir, the strategy was driven by the need for cash as well as access to foreign markets. For British Airways, the strategy was driven by the need for access to American markets, while protecting its domestic market from potential American competition. At the very least British Airways sought a strategy that would place it in a much more competitive position if the political climate changed at some point in the future. In the end, however, British Airways gained access to the U.S. market and a high measure of control over a major U.S. carrier while USAir ensured its survival for at least a few years. More importantly, the arrangement satisfies the needs of both carriers and establishes a global alliance that will work against further liberalization of the international airline market.

American Airlines

American Airlines remains the staunchest industry critic of the international code sharing and joint operating agreements described above. American argues that the British and Dutch gained valuable access to the U.S. market without reciprocal access for U.S. carriers in the European market. The airline suggests that political pressure to save jobs and service to key hubs in the U.S. forced the government to support the European bailout of two major U.S. carriers ("Mixing of U.S...", 1992). The deals effectively limit competition in the U.S. by keeping carriers aloft that might easily have followed Pan Am and Eastern into the grave. Further, the alliances limit competition in Europe by removing the most

attractive bargaining chip available to the U.S. government in "open skies" negotiations: access to the huge U.S. market.

American's political strategy involves continued pressure on the DOT and other U.S. policy makers to recognize the asymmetries of the KLM-NWA and British Airways-USAir deals. Commercially, American has negotiated a number of code share agreements with several foreign airlines, but remains committed to its demands for open access and competition in Europe. The problem is that as the NWA and USAir code share deals take on a more permanent character, it becomes difficult for American to resist jumping on the joint operating bandwagon to insure that it isn't closed out or left in a weak position in the event of real liberalization of the international market. Unfortunately, such moves tend to reinforce the structure of the market that makes code sharing and joint marketing programs the dominant tools to compete and limit competition in international air travel.

Delta Airlines

Delta Airlines is a strong competitor in the international airline market and a proponent of liberalization. Delta has a number of code sharing arrangements, but these primarily work to supplement Delta's broad service network. Recently Delta initiated an innovative strategy with Virgin Atlantic Airlines. In a twist on the standard code share scheme, Delta would market seats on Virgin Atlantic after buying them from Virgin at wholesale prices. The strategy gives Virgin access to Delta's large service network and gives Delta access to London's Heathrow Airport. Delta is quick to point out that this is not a permanent solution and it would rather have open access and real competition at Heathrow and other European destinations. Nevertheless, the deal has been struck and further establishes such joint operating agreements as the standard way of doing business in the international airline market (Fuhrman, 1995).

Delta, like American, is healthy and wants open competition, yet finds the political track unproductive. While it continues to push for liberalization it is forced to take globalization measures that may very well make liberalization less likely in the near future. Code sharing by American and Delta lend support to that tactic as an acceptable strategy for globalizing the market, thus giving tacit support for the NWA and USAir deals that have dramatically restructured the market.

Conclusion

We draw several conclusions from this preliminary research on the international airline industry. First, the standard dichotomy of protection versus liberalization is not as useful as it might be in other industries. This is because airlines can pursue globalization strategies that appear to support liberalization when in fact such strategies tend to erect barriers to liberalization and reinforce anti-competitive practices. A second conclusion is that the dual track model provides some useful clues as to why firms that we would expect to prefer open competition resort to code share and joint operating agreements that are

likely to make liberalization more difficult. This seems puzzling when considering firm preferences and behavior in the traditional endogenous tariff framework, but when firm behavior is considered in both the political and commercial contexts simultaneously, such behavior appears almost inevitable. The longer it takes for governments to liberalize the international air travel market, the more likely these carriers are to pursue commercial strategies that protect their short-term interests.

Finally, we conclude that a better understanding of the prospects for real liberalization and competition in the airline industry may help answer similar questions about other service industries. Our finding that globalization and joint operating strategies might actually serve anti-competitive and protectionist interests should be a sobering conclusion for policy makers and consumers that support globalization strategies as the means to more efficient firms and industries in the future.

This study demonstrates that globalization strategies need more scrutiny by academics and policy makers. This is especially true in light of current deliberations over raising the limit on foreign ownership of U.S. carriers from 25% to 49%. While such plans may resolve the immediate financial crises of some U.S. carriers and preserve jobs and other politically important benefits, there are dangers associated with further opening the U.S. market without reciprocal liberalization in Europe and other regions.

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Situated Learning: A Theory for Learning Situation Awareness

Donna Forsyth Wilt and Philip Horton

Florida Institute of Technology

Abstract

In aviation, situation awareness is the accurate perception of the factors and conditions affecting the aircraft and flight crew. The pilot's situation awareness in the flight environment is recognized as an important factor in flight safety, yet no known training method exists for improving situation awareness in novice pilots. The educational theory of situated learning is based on the idea that learning takes place as an interaction between a novice, an expert, and their social and physical environment. This theory has many commonalities to flight training with the student as the novice, the instructor as the expert, and the flight training environment as the physical environment. Based on this theory, the theories of situated learning are related to the flight environment and the way in which these educational theories could be used as a foundation in developing instructional techniques to improve situation awareness.

Situation Awareness and Its Importance

Situation Awareness (SA) is a cognitive process that occurs in many situations. SA has various definitions, but in aviation, most definitions share the common theme that SA is the accurate perception of the factors and conditions affecting the aircraft and flight crew (Edens, 1991). An operational definition of SA is when the pilots know (a) the state of their own aircraft, (b) the person or thing in charge—the pilot or an automated system, (c) the evolution of events over time, (d) the spatial relationships among aircraft and other objects, and (e) the presence of threat and their objectives (Harwood, Barnett & Wickens, cited in Fracker, 1988). Endsley (1988) describes three levels of SA: Level 1 is the perception of some element in the environment, Level 2 is the elements being put together to form patterns and a holistic picture of the environment, and Level 3, the highest level, is the projection of the elements of the environment into the near future.

In some instances, SA can be a matter of life or death. Accidents caused by pilot error far outnumber accidents caused by mechanical problems in aviation today. As technological advances have made aircraft more reliable, the percentage of accidents due to malfunctions has decreased, while the percentage of accidents due to pilot error has increased (Forsyth and Shaughnessy, 1978).

When a pilot does not have an accurate perception of the factors and conditions affecting the aircraft and flight crew, performance can suffer, mistakes can be made, and accidents can result. The risk of poor performance increases with poor SA (Endsley, 1993). Therefore the aviation community strongly believes that increasing a pilot's SA will improve pilot performance and improve safety (Schwartz, 1987).

Two areas for research in increasing a pilot's SA are cockpit design and education. Current studies related to SA have been from a psychological and human factors point of view and have focused on finding better definitions for SA and measuring SA (Crabtree, Marcelo & McCoy, 1993; Endsley, 1988, 1990a, 1990b; Fracker, 1988; Hartman & Secrist, 1991). Now that the meaning and measurement of SA has been clarified, SA can be studied and researched from an educational perspective.

The models of SA agree that SA occurs when patterns perceived in the environment are matched to schema in long-term memory (Fracker, 1988; Kass, Herschler I Companion, 1990; Endsley, 1988). The model proposed by Stokes, Kemper, and Marsh (1992) adds the idea that not only must schema be matched, but the pilot must have the ability to determine which cues in the environment are relevant to perceiving patterns. Based on the model developed by Stokes and his colleagues, inexperienced pilots lack two things: the repertoire of schemata, and the ability to determine which cues are relevant.

When Stokes, Kemper, and Marsh (1992) tested novice and expert pilots, they found two interesting correlations. First, they found no difference in the inherent cognitive abilities of novice versus expert pilots. This implies that SA is not an inherent skill. Second, they found that certificates (private, private with instrument rating, commercial pilot, flight instructor, or air transport pilot) were a better predictor of relevant cue recognition than total flight hours (for certificates, sr^2=0.49, n=26, p<0.001).

One method to improve SA is to design new systems and displays. However, as noted by Hartman and Secrist (1991), these systems and displays tend to have little impact on the larger aviation community and tend be aircraft specific. An alternative approach for improving SA is to treat SA as a generic skill exercised by all pilots. The findings by Stokes et al., which state that SA is not an inherent skill, are consistent with the idea that SA is a teachable skill. If SA is a generic skill, then pilots can then be trained for enhanced SA that will be aircraft independent (Hartman & Secrist, 1991).

Typical flight training programs (private certificate or instrument rating) do not specifically address SA at all. The flight portion of the training is designed to teach the mechanical and procedural skills of flying. The ground portion of the training, at best, only raises awareness of SA with respect to the decision-making process (*Instrument Commercial Manual*, 1994). The *Instrument Commercial Manual* (1994), a popular textbook for instrument and commercial ground school, points out the importance of SA. Although the manual states that good decision making is predicated on having good SA, it gives no advice on how to achieve it. To achieve SA, the theory of situated learning provides a foundation around which SA can be learned when added to flight training curriculums.

The Indexicality of Knowledge

Situated learning is built around the concept of the *indexicality of knowledge*. In indexicality, pieces of knowledge each refer to, point to, or index, some part of the world; and these pieces are inextricably a product of the activity and situations in which they are produced (Brown, Collins & Duguid, 1989). This concept implies that knowledge is inherently embedded in the situation. Therefore, learning methods must be similarly embedded in realistic situations. Brown and his colleagues draw an analogy between knowledge and a jig-saw puzzle. Knowledge is coded by and connected to the activity and environment, just as the pieces of the puzzle are coded by the picture and the shape of the pieces. Using this analogy, SA is accurately putting together the jigsaw puzzle of knowledge.

Authentic Activity in Flight Training

In situated learning, activities that preserve and present the jigsaw puzzle of knowledge and are coherent, meaningful, and purposeful are given the name "authentic activities" (Brown et al., 1989). In aviation, authentic activities are those activities involved in a flight from one airport to another and the realistic activities that should or might occur on the flight. According to Brown et al., when activities are transferred to the classroom setting, typically they are distorted and become part of the school culture instead of the authentic culture. When taking a task from real life to the classroom, an attempt is often made to separate the salient features from the peripheral "noise." But according to Brown et al., the context of the activity is extraordinarily complex. Essential support is drawn from the complex setting, and it is impossible to know what "noise" can be separated out. So the classroom activity is not only missing some of its important features, the students may also come to rely on features that appear in the classroom context that would not appear in the authentic activity.

In situated learning, the emphasis is on learning not teaching. Lave and Wenger (1991) go so far as to define a "learning curriculum" as one that is comprised of situated opportunities for the improvisational development of a new practice or goal. "The practice of the community creates the potential 'curriculum' in the broadest sense. ... A learning curriculum unfolds in opportunities for engagement in practice" (p. 93). A learning curriculum is a set of learning resources, not something that can be considered in isolation, manipulated in arbitrary didactic terms, or analyzed apart from the context of its environment.

Knowledge of the situation in the flight environment agrees well with the concepts of the indexicality of knowledge and authentic activity. However, contemporary flight lessons are a juxtaposition of maneuvers and procedures that would never occur together on a real trip (*Aviation Instructor's Handbook*, 1977; Kershner, 1989). Missing from the lessons are

the coherent navigation, orientation, and communication activities in the context of an authentic trip. Much of the indexical knowledge that is embedded in a real trip and is used as part of SA has been omitted or subordinated in the local flight lesson. The typical situation that exists in a lesson to practice a flight maneuver or procedure is different from the situation when the maneuver or procedure is actually needed or encountered in a real flight. The salient features used to determine SA cannot be separated from the noise in the environment in which it occurs. The same piece of knowledge that is crucial in one situation may be unimportant in another situation. This distortion of authentic activities applies even when the classroom is an airplane or simulator. The implication is that SA must be experienced in the context of real events in which consequences can unfold and schemata can be built. Schemata that are used to determine SA must be as authentic as possible. As stressed by Brown et al., the learning methods must also be embedded in authentic situations.

Within situated learning, the general methods to support learning are based on Vygotsky's cognitive theory of "zones of proximal development" (Lave & Wenger, 1991), on the expert–novice relationship between teacher and student (Brown et al., 1989, 1993; Greenfield, 1984, Lave & Wenger, 1991; Rogoff & Gardner, 1984), and on a teaching technique called "scaffolding" (Greenfield, 1984). Parallels can easily be drawn between the methods proposed by situated learning and the flight training of novice pilots.

Zone of Proximal Development

Vygotsky's "zone of proximal development" is the distance between the learner's ability when working independently and the learner's ability when assisted by or collaborating with a more experienced person. The zone of proximal development defines the formative stages of the knowledge that exists for the learner. According to Vygotsky, the learner first carries out an activity in cooperation with a teacher; that activity then has to be mastered inter-individually before it can be mastered intra-individually. The learner, in working with the experienced person, not only solves a problem that could not be solved alone, but also moves closer to being able to do it alone (Greenfield, 1984).

In flight training, zone of proximal development is apparent in early lessons in a curriculum when the instructor provides substantial coaching to enable the student to complete a task. As the student progresses, the instructor assists the student less and less. Zone of proximal development is also apparent in flight lessons when a situation arises beyond the scope of the lessons, and the instructor "talks the student through it" rather than the instructor doing the activity for the student. Such a situation is an important learning opportunity because the student performs a task that couldn't be done alone, and the student also moves closer to being able to do the task alone. In such situations, the instructor, acting as an expert, helps the novice student, much the way an expert mentors an apprentice.

Flight Instructor as Expert Pilot

As illustrated above, the student–flight instructor relationship is an apprenticeship-type relationship even though it is not usually thought of in these terms. In the classroom setting, the flight instructor is the expert, regardless of the instructor's experience, while the student is the novice, regardless of the student's prior ratings. The descriptions of apprenticeship-type learning in the literature agree with the way much of the learning takes place in the cockpit.

Lave and Wenger (1991) emphasize that in apprenticeship the novice is given peripheral tasks that can be done with the novice's skill level, while the overall task is beyond the skill level of the novice. At the same time, the novice observes the expert, works with the expert, and gradually picks up the expert's knowledge. This learning process is referred to by Lave and Wenger as "legitimate peripheral participation."

A concept that is similar to legitimate peripheral participation but captures the student doing more than just peripheral tasks (such as SA in flight training) is "proleptic instruction." Proleptic instruction, defined by Wertsch and Stone (as cited in Rogoff & Gardner, 1984), takes place when a novice learns information and skills by observing an expert while participating at a comfortable, but slightly challenging, level. Proleptic teaching is an integration of explanation and demonstration with an emphasis on the learner's participation in the activity. Proleptic instruction is a deliberate but tacit process that the participants construct in the course of communication. As with legitimate peripheral participation, when the novice performs a task under the expert's guidance, the novice participates in creating his or her own contextual knowledge while at the same time acquiring some of the expert's understanding of the situation (Rogoff & Gardner, 1984). This could also be thought of as the novice "stealing" the important knowledge from the expert, the way an aspiring football player steals a move from the star player (Brown & Duguid, 1993).

Legitimate peripheral participation and proleptic instruction both include the transfer of responsibility for the management of the task from the expert to the novice as a crucial feature of the learning process (Rogoff & Gardner, 1984). To turn over responsibility, the expert must be sensitive to changes in the novice's zone of proximal development and provide only enough support to bridge the gap between what can be done by the novice alone and what can be done with the expert's help.

In flight training, the instructor, as expert, can provide guidance, serve as an example to the student, and pass along important knowledge. Handling radio communications is an example of proleptic instruction. The instructor has the student handle routine communications and assists as needed to handle the more complicated transmissions. Through the course of conversation, the instructor passes on his or her own knowledge of techniques and procedures for communicating and managing the radios. As the student

progresses, the instructor reduces the support and increasingly turns over responsibility for radio communications to the student.

Flight Instructor as Scaffolding

Radio communications is not the only area in which the instructor provides support. In general, the flight instructor provides support in many ways for the flight student to enable a successful flight lesson, and the instructor always has overall responsibility for the flight. With SA in particular, the instructor, as the expert, initially takes on the responsibility of SA while emphasizing the learning of procedures and psychomotor skills. The instructor provides support for SA by filling in the student's "mental picture" as needed. As the student progresses, the responsibility for maintaining SA is progressively turned over to the student.

An analogy can be drawn between the role of the instructor in providing support and the scaffolding used in construction. The metaphor of an instructor as scaffolding was originated by Wood, Bruner, and Ross in 1976 (as cited in Greenfield, 1984), and a whole theoretical model for teaching has evolved around it. Greenfield (1984) emphasizes five things teachers have in common with construction scaffolding: (a) both provide support, (b) both function as a tool, (c) both extend the range of the worker, (d) both allow the worker to accomplish a task not otherwise possible, and (e) both are used selectively to aid the worker where needed. She also points out, however, that this analogy breaks down when considering that a teacher helps the student learn and thereby eliminates the need for scaffolding. A physical scaffolding could never eliminate the need for its own existence.

The key to success with scaffolding is two-fold. First, the instructor must determine just how much support the student needs and provide this appropriate level of support. Then, as the student's capabilities increase, the instructor must decrease the support to match the student's decreasing needs and let the student assume responsibility. The instructor's support should be calculated so that the student is always at a level just beyond that which the novice could manage independently (Rogoff & Gardner, 1984).

Scaffolding is closely related to the idea of cooperative learning between an experienced and inexperienced person. Scaffolding represents an imbalance of responsibility in which the inexperienced persons have as much responsibility as they can handle. The experienced person has a greater responsibility for the successful accomplishment of the task and compensates for the inexperienced person's weaknesses (Greenfield, 1984).

Scaffolding is similar to, but different from, the Building Block method of instruction (based on Skinner's idea of shaping) currently taught to flight instructors (*Aviation Instructor's Handbook*, 1977). Both create an environment that reduces failures and allows success. In shaping, the final task or behavior is broken down into a series of simplified approximations to the final behavior, and each one is successfully learned before moving on to the next approximation. In scaffolding, the task or behavior is not simplified or broken

down into approximations. Rather, the scaffolding holds the task constant and simplifies the learner's role through graduated intervention of the teacher (Greenfield, 1984).

Again, this fits the case with SA. For example, as a beginning flight student learns to keep track of the airplane's location, the instructor has a greater responsibility initially because the student is weak in this area.

Cognitive Apprenticeship

Bringing together the concepts of indexicality of knowledge, scaffolding, and proleptic instruction, Brown et al. (1989) coined the term "cognitive apprenticeship." The term apprenticeship is used to emphasize the importance of authentic activity in learning and knowledge and to highlight the "inherently context-dependent, situated, and enculturating nature of learning." (p 39). The term cognitive implies that apprenticeship techniques can be applied beyond the physical skills usually associated with apprenticeship to cognitive skills.

Learning Situation Awareness

Based on the educational theory of situated cognition, Young (1993) has identified four tasks for designing situated learning: (a) selecting the situations, (b) providing scaffolding for the student, (c) determining and supporting the role of the teacher, and (d) assessing situated learning. These four tasks, combined with Stokes' theory of schema matching and the general philosophy of situated learning, give five ways in which situated learning can be applied to help flight students learn SA.

First, the context-dependent nature of knowledge and learning must be recognized. SA requires developing a repertoire of schemata developed through interacting with the an authentic environment. Flight training needs to provide the opportunity to develop as many of these schema as possible. The idea that SA can only be gained through experience is correct, but many of the experiences can be provided during flight training.

Second, both simulator and flight lessons must be made as authentic as possible by anchoring them to realistic flight scenarios. Selecting the situations is important so that the curriculum sets up opportunities for events to unfold and students can engage in practice. The schemata that the student develops in training can then be built around realistic occurrences.

Third, a learning environment must be designed to include the richness of the authentic environment instead of trying to separate the salient features from the noise. Students should be given the opportunity to observe expert pilots who are operating in the environment. Through proleptic instruction, students learn from experts which cues are relevant in different circumstances.

Fourth, the lessons must be designed to keep the SA portion constant and have the instructor provide the scaffolding needed so the student can perform successfully in the authentic environment. Instructors should be provided with training so they understand and use the principle of scaffolding. The students should be working just beyond what they are able to do alone and gradually handed off responsibility for maintaining SA.

Finally, assessment techniques should be defined that measure the student's SA skills.

Summary

Situation Awareness is recognized as a cognitive skill important to the safety of aviation. However, currently no known curricula specifically include SA training in the flight curriculum of novice pilots. The educational theory of situated learning fits well with the task of SA and could be used as a foundation for developing a method to help students learn SA. Based on situated learning, designing flight training that includes learning SA should be based on authentic situations in which students can develop schemata that capture the interrelationship of events. Students should be working at a level beyond what they can do alone by collaborating with the instructor. Instructional techniques such as scaffolding should be used to provide support to students, as needed, with a gradual reduction of that support as the student takes over responsibility. Finally, the flight training should be developed so that students, being novices, can learn a great deal from observing their instructor. This can be exploited in the area of SA. Future research should be done to evaluate the effectiveness of a curriculum that attempts to improve SA of novice pilots through flight lessons based on situated learning theories.

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